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Virtual instruction during the COVID-19 pandemic

Katie B. Kelley
James Madison University

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Kaitlin B. Kelley, M.A.

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Committee Chair: Tiffany Hornsby, Ph.D.

Committee Members/ Readers:

Tammy Gilligan, Ph.D.

Kristina Doubet, Ph.D.

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Abstract

Student motivation and the impacts of the school environment on it have been heavily researched. However, motivation during the COVID-19 pandemic has not been studied in detail due to the recency of events. To understand how the pandemic impacted student motivation, this study applied the Self-Determination Theory (SDT) in understanding how motivation functions through three pieces: autonomy, competence, and relatedness (Deci & Ryan, 1985). This current study examines students' perceived motivation in virtual and hybrid instruction during a pandemic from students' perspectives. It used surveys from a similar study with the addition of qualitative questions about instructional strategies (Edwards, 2009). These strategies were used by their math teachers, and the study gathered information about what students remembered and what they thought were motivating strategies. Competence, autonomy, and relatedness were not found statistically significant when compared with grades. Qualitative data revealed what strategies students remembered and which ones they found motivating. Future studies should focus on how grade inflation impacts level of motivation compared to achievement. When applied to the practice of school psychology, this study adds more understanding of the impact of the COVID-19 pandemic on the learning environment and student motivation.

*Keywords***:** motivation, academic achievement, self-determination theory (SDT), adolescents, middle school, teachers, virtual instruction, survey, COVID-19, pandemic

Introduction

Background

Over the past year, preventive strategies against the spread of the COVID-19 virus have changed daily life. This has led to drastic consequences in the workplace, education, and home life (Cachón-Zagalaz et al., 2020). The rapid shift, due to stay-at-home orders, caused disruptions in teaching and learning (Zaccoletti et al., 2020). One area of concern in the United States is the influence on education during school closures due to COVID-19. While researchers have focused on the impact of the virus on health, there is a wide gap of information on how COVID-19 impacts other aspects (Cachón-Zagalaz et al., 2020). For instance, how students in the K-12 public schools handled the transition to virtual or hybrid instruction remains largely unknown. Students faced multiple novel experiences that could have positive and negative impacts on their learning, relationships, and emotional well-being. Additionally, researchers have predicted both short-term and long-term negative effects on education for these students (Collet & Berman, 2021).

Expected challenges include students developing certain habits or expectations because of the change in mode of instruction. During the COVID-19 pandemic, Giuntella et al. (2021) found that college students had fewer average steps per day (i.e., from 10,000 to 4,600 steps per day, on average) even after an intervention. Also, there were increases in sleep and screen time (Giuntella et al., 2021). As a result, stay-at-home orders may have exacerbated mental health issues (Giuntella et al., 2021). Younger students may have experienced similar changes in behavior and habits. The adjustment from an environment full of social interactions, hands-on activities, and demonstrations

to a singular method of instruction could be challenging (Debbarma & Durai, 2021). When switching to a virtual platform, students may have experienced obstacles of delayed responses and lack of nonverbal communication. These obstacles were exacerbated by internet issues (Hamilton et al., 2020).

While some changes resulting from the COVID-19 pandemic brought challenges, others may have improved school environments, like the connection between school and communities. For some school systems, administrators found an increase in communication between home and school during the virtual learning experience (Collet & Berman, 2021). Collet and Berman (2021) observed school personnel developed more cultural competence as teachers and staff made home visits throughout the pandemic. The staff recognized strengthened home-school connections that had not occurred in previous years despite the obstacles of receiving adequate education virtually (Collet & Berman, 2021). While these benefits are quantitatively small, it is helpful to explore the entire impact of this unique learning experience to see the strengths as well as the difficulties.

The impact on education in rural areas during the COVID-19 pandemic may have other unstudied effects (Mueller et al., 2020). These areas previously had limited access to important resources such as healthcare and education that were further strained by the pandemic. Families had difficulties physically accessing the internet with fewer financial means for the internet (Collet & Berman, 2021; Debbarma & Durai, 2021). According to principals in California, counselors and school psychologists in rural areas expressed greater needs for high-quality materials and resources than did those serving suburban or low poverty areas during the spring of 2020 (Hamilton et al., 2020). Likewise, teachers used strategies that may have novel impact on the students' level of engagement during

the COVID-19 pandemic which needs to be further explored. Recent studies suggest that teachers felt ill-equipped for engaging students during the pandemic (Hamilton et al., 2020). Such strategies included live virtual meetings, pre-recorded instruction, and other virtual work (Hamilton et al., 2020). The impact of this historical event on students in rural communities remains largely unknown (Hamilton et al., 2020).

When facing these obstacles, it would be difficult for students to maintain the same level of motivation towards schoolwork as they had previously. While research has shown effective instructional and motivational strategies for traditional educational settings, there is a gap in current research about motivation in virtual instruction during a crisis such as the COVID-19 pandemic. Some studies have explored how teachers operate in virtual learning environments (DiPietro et al., 2008), while others explored what teachers used to help students learn virtually during the pandemic (Hamilton et al., 2020). Some past surveys assessed the students' perspective of instructional methods and how teachers motivated their students (Lazowski and Hulleman, 2015; Wiggins, 2011). Current studies addressed the concerns of administrators and teachers regarding the needs of their students during the COVID-19 pandemic (Collet & Berman, 2021). Yet, during the COVID-19 pandemic, there is little known about the students' perspectives on instructional motivating methods. The current study examined students' perspectives on their motivation during virtual and hybrid instruction in a rural community.

Literature Review

Defining Motivation

When defining motivation for research, it is hard to narrow it down to one definition because of the various perspectives (e.g., cognitive, developmental,

educational, social; Lasowski & Hulleman, 2015). Multiple characteristics for motivation include “needs, drives, goals, aspirations, interests, and affects” (Lasowski & Hulleman, 2015, p. 2). Furthermore, motivation can be broken down into two main categories: extrinsic and intrinsic. Extrinsic motivation refers to the use of tangible rewards or praise to reinforce a behavior, while intrinsic motivation requires internal drive in the student to perform the behavior (Trenshaw et al., 2016). These two categories are studied almost universally when researching motivation (Edwards, 2009). According to the social-cognitive perspective, motivation is defined as the driving force in an individual to accomplish a task. Through this perspective, interpersonal aspects, such as attitudes, are taken into consideration when studying motivation. This is the primary theoretical approach of the current study.

Importance of Motivation

Motivation remains a highly studied topic in understanding education and student success (Edwards, 2009; Li et al., 2020). Many studies have found strong relationships between motivation and academic outcomes (Kim & Frick, 2011; Wijsman et al., 2018). When students experience highly motivating environments, it may lead to an enduring drive to learn (Kim & Frick, 2011). Interventions to build successful academic achievement often rely on motivation (Lazoswki & Hulleman, 2015). Similarly, lack of student motivation relates to some difficulties in academic areas. Froiland et al. (2012) found that 25% of school referrals were due to a motivational issue. Likewise, students themselves have sensed this lower motivational drive over the past few years (Lazowski & Hulleman, 2015). Lazowski and Hulleman (2015) found that 69% of students who dropped out of high school had indicated that their schools failed to motivate them.

Using a developmental lens could help researchers understand how these students are motivated or not. Rahiem (2021) found that while adult students in Indonesia motivated themselves during the emergency remote learning due to the COVID-19 pandemic, younger students may have struggled more due to their capacity to self-motivate. Students between ages 12-17 years tend to be hyper-responsive to dopamine and reward responses in the brain than adults (Ernst et al., 2011). Because of this sensitivity, they often focus on something that rewards their brains and may give less attention to less-engaging tasks (Ernest et al., 2011). Thus, teachers need to create motivating and engaging environments for younger learners than those teaching adults. Adolescents need that additional help and modeling through learner-instructor interaction to build their motivation (Borup et al., 2014). Their developmental level is vastly different than adults and should be considered when understanding motivational needs.

As part of this developmental period, adolescents are more attuned to the social environment which can impact their academic motivation. Doubet and Hockett (2015) argued that adolescents desire to be known and fit into their social environment which, if ignored, can hinder motivation to learn. Before approaching cognitive needs in motivation, this social need must be fulfilled (Doubet & Hockett, 2015). Edwards (2009) found a positive relationship between competence and social context. Specifically, students felt more able to perform a task when their teacher was understanding and listened to them (Edwards, 2009). Considering these factors will help identify and implement motivational strategies as well as clearly defining the concept of motivation.

One new aspect of student motivation is the change in the learning environment. Students sought their parents for educational, behavioral, and mental health needs during

the pandemic. This may have caused added stress to the overall environment (Li & Zhou, 2021). Li and Zhou (2021) studied parental worry, or concern about any negative outcomes related to their children, during the pandemic. Specifically, they investigated the relationship between parental worry and internalizing and/or externalizing behaviors experienced by children during this time. Internalizing behaviors refer to withdrawal from social engagement, feelings or thoughts of worthlessness, depressive feelings, or anxious thoughts. Externalizing behaviors include disruptive behaviors, excessive movement, defiant behaviors, or aggression to others. Their results suggested that increased parental worry was highly correlated with increased internalizing and externalizing behaviors in children (Li & Zhou, 2021). While parents navigate stressors related to the pandemic, they may unintentionally influence their children's perceptions and emotional well-being. These concerns can cause obstacles to the students' overall success as they may become less motivated to continue their education virtually.

Other environmental factors affecting motivation include student resources during the 2020 pandemic. When schools converted to a virtual format, students needed stable internet connection, a working device to access the material, the knowledge to use that device, and the support of family to attend online school (Borup et al., 2020; Middleton, 2020). Sometimes, students were sharing devices with siblings, limiting individual access to school (Collet & Berman, 2021). Additionally, parents and students received instructions about virtually learning through email when some families did not have access to internet or a computer (Collet & Berman, 2021). Without a means for virtual education, many children may have lost instructional time. Middleton (2020) predicts that

the impact of loss of instructional time during the pandemic on test performance may be long-lasting.

Factors That Support Student Motivation

Several factors impact student motivation either intrinsically or extrinsically. Their environment, their view of intelligence or the academic subject, practical application of the information, and their own developmental level in adolescence can all play a role in motivation. First, the environment teachers create for their students impacts how motivated the student is. According to Nerstad et al. (2019), a motivating environment has mastery and performance climates which overlap with the concepts of intrinsic and extrinsic motivation. Mastery is like intrinsic motivation by including "progress, effort, self-improvement, and cooperation" (Nerstad et al., 2019, p. 3). Performance climates align with extrinsic motivation which is the perceived external rewards for the behavior. The type of climate present - performance or mastery - depends on the perception of the students and how the teacher engages them (Nerstad et al., 2019).

Also, how students view intelligence by their own experiences and at school can impact motivation. For example, Dweck (2006) thought that intelligence can be perceived as flexible or fixed. If teachers model the concept of a growth mindset, students have an increased chance of being more motivated to learn in challenging situations (Dweck, 2006; Doubet & Hockett, 2015; Yeager & Walton, 2011). For instance, students performed better and asked for more difficult assignments when praised on their effort (Yeager & Walton, 2011). However, their performance declined when there was more focus on intelligence (Yeager & Walton, 2011). Another obstacle is the assessment process for academic concerns. These might underestimate skills based on the student's

level of motivation (Froiland et al., 2012). While not a standard practice, the best practice for evaluations is to include a skill versus performance assessment. It can determine if poor performance is due to weaker ability (i.e., skill deficit) or lower motivation (i.e., performance deficit; Froiland et al., 2012). However, this assessment method may only detect external factors of motivation without the ability to understand internal drives. Thus, the way schools approach student motivation may not consider all aspects of motivation.

Another aspect about student motivation may be due to interest-level in the subject. Wijsman et al. (2018) found that students who enjoyed certain subjects had greater intrinsic motivation and higher grades. Wijisman et al. (2018) found correlations between less-preferred subjects and lower grades and between lower grades and higher extrinsic motivation (Wijsman et al., 2018). Extrinsic motivation can be observed in both preferred and less-preferred subjects at different levels, but intrinsic motivation increased alongside higher academic performance (Wijsman et al., 2018). While some subjects can be viewed as uninteresting, research points to more environmental factors rather than curriculum qualities for motivation levels (Wigfield et al., 2007).

Student motivation also involves how students make connections between what they learn and what they experience. Researchers argue that finding ways to connect a concept to the student's life will enable them to pursue learning it (Doubet & Hockett, 2015; Jensen, 2005). This type of connection has been studied with the concept of personalized learning (Walkington & Bernacki, 2020). Personalized learning is a broad term for tailoring learning using the students' strengths, needs, and goals. Research does

not show how personalized learning works in a school system, but it could be useful to motivate students in less-preferred subjects (Walkington & Bernacki, 2020).

While disinterest can play into motivation, another reason may be development in adolescence (Doubet & Hockett, 2015). Students at this age are undergoing major cognitive changes that make their decision-making and social engagement difficult (Jensen, 2005, p.30). This can mean that "the average 9-year-old can make a better decision than an adolescent can" (Jensen, 2005, p. 30). Because their frontal lobes take longer to develop on top of other areas grossly enlarging - like the parietal lobe - adolescents will struggle much more than younger or older students in school (Jensen, 2005, p. 30-31). To alleviate some of this challenge, Doubet and Hockett (2015) emphasized the need for student-teacher relationships helps engage student interest. They argue that because of the emotional and cognitive needs of adolescents, teachers should strive to address them (Doubet & Hockett, 2015). To do this, teachers should develop community in their classroom to motivate engagement.

As previously mentioned, what teachers do in the classroom impacts student motivation (Edwards, 2009; Hannaford, 2016). Teachers create the environment and set the tone for students as they come into class. While basic academic interventions can teach skills, research supports the inclusion of motivational interventions in order to improve academic success (Yeager & Walton, 2011). Lazowski and Hulleman define intervention as "a manipulation implemented by an external agent…that was intended to change students' cognitions, emotions, and/or behaviors" (2015, p. 5). Instructional practices with autonomy-building aspects can help create a motivating atmosphere through teachers (Lazowski & Hulleman, 2015). Other interventions may include

reflective prompts on what a student values and why they hold those values which can increase academic achievement (Yeager & Walton, 2011). This kind of intervention plays on the social-cognitive aspects of motivation to tap into a student's sense of competency. Reeve (2009) found 44 studies confirming that students benefit from autonomous environments while suffering from controlling environments. Thus, the type of motivational interventions and beliefs teachers endorse remains a vital component of effective education.

Another way to engage students is to give them a challenge that is within their reach (Doubet & Hockett, 2015). Students at this age range struggle with motivation when they feel helpless, school is irrelevant, or they feel disrespect about themselves or their culture (Jensen, 2005). Strategies to help adolescents learn and be engaged include modeling, coaching, and being understanding (Jensen, 2005). These strategies may combat the disinterest in certain subject areas which again changes the learning environment. Even the smallest intervention to remove pressure from students can make a large impact on their quality of motivation (Yeager & Walton, 2011). By implementing basic practices of giving students choices, teachers can easily influence academic success.

Factors that Hinder Student Motivation

The research has identified many obstacles to motivating students in the classroom. For example, some teaching styles can serve as obstacles to creating student motivation. Reeve (2009) found that autonomy-supportive strategies help students have greater academic success while controlling styles do not intrinsically motivate students (Reeve, 2009). An autonomous environment empowers students to freely explore their

options (Reeve, 2009). When students feel intrusion and pressure through controlling styles, their ideas and desires are hindered from expression (Behzadnia, 2022; Reeve, 2009). Teachers may have their own beliefs on how students feel motivated which impacts their interactions with a student (Behzadnia, 2022; Reeve, 2009). Their beliefs may be reinforced by students' cooperation in the classroom. A common example of controlling strategies is when teachers use grades to motivate students (Yeager & Walton, 2011). Teachers' overemphasis on grades may lead to increased student stress over perfect grades or apathy about grades (Yeager & Walton, 2011). These common obstacles happen often without anyone potentially noticing them.

The COVID-19 pandemic resulted in many obstacles to student motivation. The classroom environment changed after the start of the COVID-19 pandemic. With proper resources, some teachers were able to reach out to students in different ways. Educators with technological expertise and professional learning coaches helped address teachers' needs in technology so that they could effectively help their students (Borup et al., 2020). Their environment had great outside support and guidance to enable them to be successful. Students benefited from this community because it engaged them in learning (Borup et al., 2020). Unfortunately, these experiences and resources were not always present which can create more obstacles.

However, under-resourced teachers' stress and lack of training may hinder a motivating environment. When teachers are stressed by multiple factors, it is more difficult to create a motivating environment (Taylor et al., 2008). Such factors include time constraints, having good relationships with students, and cultivating academic success on standardized assessments (Taylor et al., 2008). Within in high-stress contexts,

these variables may lead to the reliance on more controlling styles of instruction, thereby decreasing student motivation. These factors were a concern prior to the COVID-19 pandemic and may have been exacerbated during the pandemic (Borup et al., 2020; Reeve, 2009). One big factor is the emphasis on technology use in education.

While most teachers receive training for in-person instruction, school closures because of the pandemic resulted in reliance on online instruction (Middleton, 2020). Having little or no prior professional development in virtual instruction created obstacles for teachers, affecting their students' learning (Hamilton et al., 2020; Middleton, 2020). Some teachers were unable to complete the curriculum requirements and stopped assigning letter grades during virtual learning (Hamilton et al., 2020). While grades give a summative report of a student's success, formative assessment identifies and addresses the needs of the student throughout the year. Since formative assessment often occurs in the classroom, it was difficult to do this virtually. Teachers had more concerns with assessing emotional social needs of their students than assessing their academic progress (Hamilton et al., 2020). Obviously, these were important needs, but little is known about the academic progress of students during the pandemic. However, it is difficult to determine academic needs or appropriately differentiate instruction without formative assessment.

Virtual learning posed another obstacle through weaker assessment of student needs in the classroom (Middleton, 2020). Some standardized testing, benchmarks, and other progress monitoring methods were removed due to the stress of the pandemic and infrequent contact with students. It created difficulty in accurately assessing where student learning was (Middleton, 2020). Additionally, some teachers were unable to

complete the curriculum requirements and could not assign letter grades during virtual learning (Hamilton et al., 2020). It is challenging to determine academic needs or differentiate instruction without knowing the student's level of learning.

Self-Determination Theory

Several theoretical frameworks exist to explain motivation, but one framework seems most appropriate for studying student motivation in academic environments. For this study, the Self-Determination Theory (SDT) is the most appropriate for student motivation using a social-cognitive approach (Deci & Ryan, 1985). While other theories such as Achievement Goal Theory explain motivation as a goal orientation, SDT expands the definition of motivation by including individual determination as a key aspect to motivation (Nerstad et al., 2019). Rather than focusing on the amount of motivation presented in other theories, SDT uses a framework to investigate the quality of motivation (Deci & Ryan, 2008). SDT focuses on the learning environment in connection with motivation and psychological needs (Li et al., 2020).

There are practical advantages of using this theory like guiding the intervention development process. SDT has contributed to 11 studies of intervention development that have had large effect sizes (d = .70; Lazowski & Hulleman, 2015). For instance, Reeve et al. (2004) trained teachers in autonomy support strategies for students and compared their skills to that of untrained teachers. They found those trained in autonomy support strategies used them more often and had more engaged students than the control group (Reeve et al., 2004). Other studies have used this theoretical model across different cultural populations (Bell et al., 2016; Edwards, 2009; Fernandez-Rio et al., 2015; Froiland et al., 2012; Lazoswki & Hulleman, 2015; Li et al., 2020). Because of its

versatility and frequent supported use, SDT appears to have the best fit for examining student motivation within the context of the COVID-19 pandemic.

Another fundamental part of SDT is that it describes motivation through three social-cognitive aspects: autonomy, competence, and relatedness (Bell, Kaplan, & Thurman, 2016; Deci & Ryan, 2008; Froiland et al., 2012; Hebbecker, Forster, & Souvignier, 2019). The relationship between these three factors is believed to be hierarchical; when autonomy and competency are elevated, then social relatedness can be met and results in increased interpersonal interactions (Li et al., 2020). Thus, relatedness can be seen as a lower factor in motivation compared to the other two (Edwards, 2009).

Relatedness identifies the aspect of belongingness and inclusion within a group or team that increases motivation (Bell et al., 2016). This aspect can stem from the level of support from both teachers and peers, perceived fairness from the teacher, and peer acceptance (Edwards, 2009). Again, it tends to be available when competence and autonomy are met. Environments that encourage autonomy include promoting choices, valuing a student's ideas, and allowing them to use problem-solving skills (Froiland et al., 2012). It involves showing interest in the student's perspective and "unconditional positive regard" (Legate et al., 2018). When students perceive having autonomy, they express their authentic selves and understand personal responsibility (Edwards, 2009). Competence refers to the student's confidence in their abilities and knowledge when completing a task (Bell et al., 2016). Students engage more easily with tasks in which they have more competence because they know they can be successful (Edwards, 2009). For children, this factor has the strongest impact on behavioral engagement (Edwards, 2009).

According to Edwards (2009) when these three are combined, the individual has greater engagement in the task at hand – in this case, academic achievement. This theory encompasses also cultural and social aspects for understanding an individual's reason to try and complete a task (Deci & Taylor, 2006). It stands on these three components being met in the social context to increase human potential. However, when these basic needs are not met, the individual may act in unhealthy ways to obtain goals. This can lead to specific psychopathologies according to the theory (Deci & Taylor, 2006). While low motivation may not result in severe mental disorders, lack of healthy motivation could lead to reduced well-being.

While autonomy and competence come before relatedness, their level of importance can vary depending on the student's developmental age. Causes of decreased motivation vary across grade levels (Lazowski & Hulleman, 2015; Wigfield et al., 2007). For example, there has been a specific decline in motivation for mathematics during the transition from elementary school to middle school (Edwards, 2009). It is argued that the environment along with the developmental period of a middle schooler influences their motivation (Blackwell et al., 2007). Such environmental changes include social comparison, self-assessment, and a decrease in decision making with a desire for more control (Blackwell et al., 2007). Some students can negate these obstacles through self-regulation and determination to achieve academic success (Blackwell et al., 2007). While developmental age adds another variable to how motivation occurs, an additional factor that has not been researched is learning in the virtual climate during a global pandemic.

Need for Current Study

Researchers have explored this area of virtual teaching and motivation within the context of typical circumstances (Borup et al., 2014, DiPietro et al., 2008). Prior to the COVID-19 pandemic, Lazowski and Hulleman (2015) found 75 studies that used self-report measures across K-12 and postsecondary education levels in their meta-analysis (Lazowski and Hulleman, 2015). Although the researchers found 24 of the studies at the middle-school level, they did not specify how many included a self-report (Lazowski & Hulleman, 2015). Since K-12 students have less control of their environment than that of college students, their perspectives can give unique feedback on the functionality of these strategies. Specifically, the research on students' perspective in rural areas remains relatively a mystery. However, they are just as important as staff feedback to improve the learning experience.

While much of the previous research in motivation examines college students' or teachers' views, few researchers have explored the experiences of middle schoolers during the pandemic (DiPietro et al., 2008; Li et al., 2020; Nerstad et al., 2019; Reeve et al., 2009). Chiu et al. (2022) recently studied how digital support impacts engagement and motivation through SDT lens. They used pre- and post-survey data to examine how community support for virtual learning impacted 8th and 9th grade students. By satisfying the three needs of competence, autonomy, and relatedness, students engaged better in their educational success (Chiu et al., 2022). However, this study was conducted in a Hong Kong school system and cannot be generalized to other countries without substantiation from further research. More research in other systems, like the United States, will add to what students need and how those needs can be met.

Since student learning in the United States was impacted by the pandemic, the students' perspectives of how teachers used technology could tailor the needs in professional development. It is important to consider the difference between the training teachers received and the technological demands of the fall 2020 semester (e.g. SmartBoards, Google applications, iPad uses, etc.). For instance, less than 30% of 1,000 Californian teachers reported minimal training for distance learning procedures (Hamilton et al., 2020). While 57% of these teachers had received professional development around these topics, not all teachers have knowledge or access to these trainings (Hamilton et al., 2020). Their comfortability with technology could influence their choice of motivational strategies.

Additionally, researchers have looked at the motivational efficacy in online learning to understand how it works prior to the COVID-19 pandemic (Higashi et al., 2017). For instance, Higashi et al.'s study gave information about virtual learning with intrinsically motivated students. Higashi et al. (2017) studied what kind of motivation contributes to persistence in online learning. The researchers used the Expectancy Value Theory which includes similarities to SDT such as competency. However, the Expectancy Value Theory uses cost/gain analysis rather than looking at the environment in connection with cognitive processing. They found that students stayed in online learning when they already had high intrinsic motivation and viewed themselves as competent. However, little is known about students, who are forced into online learning and may not be high achieving.

Within the context of SDT, what students perceive as motivating and what teachers use to motivate their students may not align with each other. Effective strategies

tend to have evidence supporting them. However, teachers without prior experience in a virtual or hybrid instruction may use unsupported strategies. Researchers should explore student perspectives about strategies in virtual learning and how they impact motivation. The data can provide information about what worked for students and could work in the future, especially within a crisis like the COVID-19 pandemic. Because virtual learning entered public education by force rather than by choice, there are additional factors influencing student motivation. Having student feedback may equip teachers for future teaching under similar circumstances. Rather than predicting an outcome, this study aims to give a better understanding of student experiences within this context.

Studying the experiences of others fits into the phenomenological framework which was used to this current research (Hannaford, 2016). Phenomenological studies explore why something occurs or describe what it is happening rather than predicting an outcome (Hannaford, 2016). It can include quantitative and qualitative data in conjunction with each other for a mixed methods study. Since information about schooling and motivation during the COVID-19 pandemic is scarce, this study will explore what motivation looked like during this period of time using mixed methods.

Purpose of the Current Study

The purpose of the current study was to partially replicate Edwards (2009) and extend the current literature to learn about student perceptions of motivation through virtual learning in a rural environment. The data gathered will inform educators about what works well to motivate students during a catastrophic event like the COVID-19 pandemic. Specifically, the study sought to answer the following questions:

Research Question 1: What perceived levels of autonomy, competence and relatedness did students report in virtual instruction during the 2020-21 academic year?

Research Question 2: Did students achieve higher grades when they identified higher degrees of autonomy, competence, and relatedness in their virtual instruction?

Research Question 3: What strategies do students identify as motivating their participation in the virtual instruction?

Methods

Participants

Using convenience sampling, participants were recruited from seventh and eighth grade classes in a middle school in a rural county in southeastern Virginia. This county holds 19,819 people, 23.8% of which are under the age of 18. About 87.6% of the population are White, 7.3% are Black/ African American, 6% are Hispanic, and 2% are Asian (U.S. Census Bureau, 2019). Roughly 7.6% of the population lives below the poverty line, the majority of which are White. Participants included current seventh and eighth grade students who attended this middle school in the fall semester of 2020. While 65 consent and assent forms were returned, only 41 students participated in the study. Two survey responses were removed due to the students not attending a math class that fall although they attended this school. Among those 39 students, 20 were sixth graders and 19 were seventh graders in the fall 2020 semester. Sixty-three percent of those students had attended school in a blended format (two days in-person and two days virtual) while the remaining 37% attended all virtually.

Measures

Two preliminary questions were asked before students proceeded to these surveys. The first question asked if the students attended the school during the fall of 2020. The second question referred to whether they participated in hybrid or virtual learning defined by this school's system operations. Virtual learning consisted of four days of virtual classes followed by one day of asynchronous work, and hybrid learning consisted of students attending school two days per week with the remaining three days being asynchronous work.

Demographic information was also collected including grade level, mode of attendance (all virtual or hybrid), and academic grades which remained confidential.

To assess student perspective on a quantitative level, Likert scales have been effectively used in previous studies (See Appendix F; Steinmayr et al., 2019). One method for gathering information through an SDT lens includes surveys by Deci and Ryan, the original developers of SDT (Edwards, 2009; Deci & Ryan, 2006). In Edwards' study, a combination of the Learning Climate Questionnaire (LCQ), Perceived Competence Scale (PCS), and Basic Psychological Needs Satisfactions Scale (BPNS) was used to gather data around the variables of self-determination (2009). This combination follows the individual recommendations of the Center for Self Determination Theory for proper use of each survey. The authors, Deci and Ryan, gave approval for the academic use of these surveys for this study.

This study used the LCQ, PCS, and BPNS. Some slight adjustments were made for these surveys because of the purposes of this study. These changes do not disrupt the integrity of the instruments as will be explained in the descriptions of each survey.

Internal consistency for each variable of motivation was high using Cronbach's alpha. This study proposes to examine students' perceptions of motivational strategies used for virtual instruction during COVID-19 pandemic.

Learning Climate Questionnaire. The LCQ has 15 questions on a 7-point Likert scale to assess how motivating the learning environment is for students including the choices/options teachers provide. According to Edwards (2009), autonomy support in the environment predicts the satisfaction of basic needs to be motivated. The LCQ has high internal consistency with an alpha coefficient of .90 or above. It was validated through a study with medical students (Edwards, 2009). The score is the average of all item scores, and higher scores indicate greater autonomy support.

Perceived Competence Scale. The PCS uses 4 questions on a 7-point Likert scale to assess how students perceived their competence in an academic subject area. Previous studies used this survey to assess glucose control in diabetic patients as well as medical students learning in a college course (Williams, Freedman, & Deci, 1998; Williams & Deci, 1996). In these studies, the alpha measure of internal consistency was above .80 (Williams, Freedman, & Deci, 1998; Williams & Deci, 1996). Edwards (2009) also included this survey to assess competency of middle schoolers in math classes in correlational analysis with the Learning Climate Questionnaire (LCQ). This relationship was studied to identify motivational aspects in connection with social context.

Basic Psychological Needs Satisfaction Scale. The BPNS uses different domains of items to assess autonomy, competence, and relatedness, but for the purpose of this study, only items assessing relatedness was used. In Edwards' (2009) study, items pertaining to relatedness satisfaction and frustration were the only items used. Since the

LCQ and PCS assess autonomy and competence, assessing the area of relatedness alone in the BPNS seems most efficient. In the study by Baard, Deci, and Ryan (2000), the BPNS on the motivational basis of performance in work settings received a Cronbach's alpha of .79 in the subscales of relatedness.

All three surveys use 7-point Likert scales which have been primarily used with adults. However, they were reduced to five points because previous research recommends this for younger participants. Researchers have examined performance and accuracy on Likert scales with more or fewer points (Mellor & Moore, 2013). They found that younger students performed with more reliability and accuracy when the Likert scales had between three and five points. Other evidence-based scales have adopted these reduced Likert scale points which is the rationale for reducing the Likert scales in this current study.

Also, there was a set of questions that asked students about strategies their teachers used. This list was created through consultation with 6th and 7th grade math teachers. On the survey, students had to select which strategies they remembered their teacher using. Additionally, administrators and teachers were asked for any information they would like to gather from the students to help their system. If they had questions about teaching strategies or motivation, these questions could have been included to gather data for specific purposes. However, they did not have additional questions to add to the survey.

Finally, there were two qualitative questions following the list of strategies about motivation: *How motivating were these strategies for you?* and *Are there other strategies not listed that would have been motivating for you?* They were formatted as free-response

items on Qualtrics. These questions were used to get qualitative data on perceived motivation to align with the quantitative data.

Procedure

After receiving approval from the Institutional Review Board at James Madison University, the researcher started the survey process. First, the researcher consulted with Physical Education (PE) teachers about giving the surveys during their class period. There were four PE teachers who each had four sections of classes - two per grade level for 7th and 8th grade. In the spring of 2022, all four teachers made two-week rotations of health classes in the cafeteria. Instead of having all four classes at once in the gym, they had one class at a time in the cafeteria.

Second, parental consent and student assent forms were distributed in the cafeteria for three of the four teachers (See Appendices A and B). The last teacher had completed her health classes prior to the start of this study. Before students received consent and assent forms, a video was played about the study created by the high school intern. Out of the 393 students in 7^{th} and 8^{th} grade P.E. classes, 65 forms were returned. While 41 students had parental consent and gave assent to participate, 39 students completed the survey who met the preliminary requirements. All students received two pieces of candy from a bulk bag for returning the survey, even if consent was not obtained.

Third, the surveys were administered to students in their P.E. health class – except for the last class which participated in the gym. Time was set aside at the beginning of their health /P.E. class to take surveys. Each student received an email with their code number and a link to the survey that was emailed five minutes before class started. This was to ensure that the email was accessible. The survey was administered through

Qualtrics (See Appendix C for the survey items). Most students took between 5 and 15 minutes to complete the survey while other students completed alternative activities or played on their devices. While the latter was not given as an option, it occurred.

Data Analysis

Before the data analysis, G-Power was used for an a-priori estimate of how many students were needed for this correlation study with a moderate effect size (0.5). After the completed data analysis, another G-Power analysis was conducted to understand the statistical power.

After data were collected, they were cleaned by removing unnecessary information and entering values for some of the variables and analyzed using SPSS software. The grand mean of the three motivation variables was obtained by each students' response score for each motivation variable. A student's score was the mean of the Likert scale responses with some including reverse scored items. Overall mean grades for each teacher were gathered from the individual grades. Bivariate correlation and linear regression analysis were conducted to understand the relationship of these variables. It included grades and average scores on each survey (LCQ, PCS, BPNS). These correlations and regressions were put into histograms and linear graphs to inspect the data.

When analyzing data from the two qualitative questions, the responses were categorized by theme. To establish stronger reliability, the other current intern reviewed the responses and categories to determine how appropriately they fit with each other. This was done through a shared document where the responses were grouped by a category. When there was disagreement between raters, both raters met to resolve by consensus.

Results

The results from this study include sample size, grades, survey responses, and the relationships between the survey responses and grades. SPSS was used to obtain statistical information while thematic coding with two raters was used for qualitative data. There are two introductory points of data that contribute to the overall study. First is time spent on the survey. It was estimated that survey would take roughly 15 to 30 minutes to complete. However, the average time it took students was 5 minutes - the median was used due to such skewed numbers (median=5.00, SD= 2.95). Second, the average grades for each class were similar – between a B- and an A+ (See Table 8 in Appendix F and Figure 8 in Appendix G). This information lays foundation for the remaining results and discussion when considering time put into the survey and how equal students' achievement was.

Research Question 1

First, responses on the survey were used to answer the first research question. The means from each respondent and the descriptive statistics of overall means were calculated (see Table 4 in Appendix F). Cronbach's alpha was used to determine the internal consistency of each survey. For the LCQ, students stayed neutral or agreed with having an autonomous learning environment. The mean, median, and mode were similar (3.74, 3.76, 3.71, respectively), and the standard deviation was 0.69. It had an internal consistency coefficient of 0.94 which is strong and consistent with previous research (Edwards, 2009). However, students leaned towards more agreement with having competence on the PCS (M=4.03, SD=0.93). The internal consistency was 0.89 which was strong and consistent with previous research (Williams, Freedman, & Deci, 1998;

Williams & Deci, 1996). There was also more variability on the PCS in responses. On the BPNS, students had lower agreement or were neutral on perceived relatedness (M=4.13, SD=0.59). It had an internal consistency coefficient of 0.78 which was close to what Baard, Deci, and Ryan (2000) found in their study. Overall, students viewed their learning environment as autonomous, perceived themselves as competent, and felt connected to their peers and teachers.

Research Question 2

To answer the second research question, the fall 2020 semester grades were compared to survey responses. Most students who participated in the study achieved an A in their math class. This was determined by the mode since the data skewed to the right. The mean would be a B+, but only six students received a B+ compared to the eleven students who got an A (See Table 2 in Appendix F). Because SPSS only allow numerical values to be entered, the numbers represent specific letter grades which is explained in Table 3 (See Appendix F).

Next, a correlation analysis was conducted to determine the relationships between each student's grade and survey scores. The significance level, α, was set at 0.05. First, results of perceived autonomy and grades were not found significant (r =-0.02, p-value= 0.92). Also, the results of perceived competence and grades were not found significant (r =0.20, p-value=0.22). Third, relatedness (via BPNS) and grades were not found statistically significant with a (r = 0.12, p-value=0.48).

Following the correlations, a regression analysis was conducted for all three variables together and separately to see how well these variables predicted grades. Again, the significance level, α, was set at 0.05. For the overall regression, these three variables

are not valid predictors of grades with r^2=0.16. Individually, none were statistically significant predictors of grades (See Figures 5-7 in Appendix G).

Prior to the study, G-Power was used to determine the number of participants needed for the study. Initially, an a priori analysis for a correlation with a medium effect size (ρ=0.5) had 0.955 statistical power and required 42 participants. After gathering data from the 39 participants, the statistical power for the correlation was 0.611. In other words, there was a 61% chance that these results would be found statistically significant. For the regression statistical power, it was 0.652. Again, it gave a 65% chance that the results would be found significant. However, the a priori for this regression required 89 participants to have a statistical power of 0.950. The recommended power level is 80% (1 - β) which means these results have statistically weak power. Thus finding statistically significant results in this study - even when they exist - will be difficult.

Research Question 3

A checklist of strategies and two qualitative questions were given at the end of the survey to answer the third research question (i.e., *How motivating were these strategies for you?* and *Are there other strategies not listed that would have been motivating for you?*). For strategies, teachers gave a list of what they used during the fall semester of 2020. Then, students checked off the ones they recalled their teachers using. The strategies were presented altogether regardless of who used which strategy. The frequency for each strategy ranged between one and 33 being recalled. The top five strategies recalled were Quizizz (*n*=33), Google forms (*n*=31), Edpuzzle Videos (*n*=31), Quizlet (*n*=29), and Kahoot (*n*=29; see Figure 8 in Appendix G).

Most of the responses were simple affirmative or negative responses rather than true free responses (see Table 6 in Appendix F). However, those who gave specific responses to the questions mentioned hands-on or in-person activities as well as specific strategies like Kahoot or guided notes. Also, students who responded that strategies were motivating and/or listed specified strategies that worked remembered more strategies. Because the responses for each category are skewed, the mean, median, and mode have been shown for comparison (See Table 7 in Appendix F).

Discussion

The purpose of the current study was to learn about student perceptions of motivation through virtual learning in a rural environment. It sought to answer three research questions. First, regarding research question 1 (What perceived levels of autonomy, competence, and relatedness did students report in virtual instruction during the 2020-21 academic year?), students reported moderate levels of autonomy, competence, and relatedness. For autonomy, students swayed between a neutral stance or agreement with their teachers providing autonomous environments (M= 3.74, SD= 0.69). They typically agreed with feeling competent about their skills (M=4.03, SD=0.93). Also, most students swayed between feeling neutral or agreeing about having relatedness needs met. While these results show student perceptions on motivation, the next two research questions address whether the students were engaged with their math classes. According to SDT, when these three factors are met, then students should feel motivated to achieve goals (Deci & Ryan, 1985). However, to determine whether students were motivated, information about their engagement level is needed. This is answered in the results of the next two research questions.

For question 2 (Did students achieve higher grades when they identified higher degrees of autonomy, competence, and relatedness in their virtual instruction?), there were no statistically significant relationships between academic achievement (as measured by grades) and perceived autonomy, competence, or relatedness. This information does not align with previous studies including Lazowski and Hulleman's study (2015). In their meta-analysis of 109 studies, student motivation was a predictor of academic achievement (Lazowski & Hulleman, 2015). Other studies have provided evidence of relationships between these three factors and student engagement, especially when providing motivation interventions (Chiu et al., 2022; Edwards, 2009; Yeager & Walton, 2011). In virtual learning, Chiu et al. (2022) found that when these three factors are meet, students have higher levels of engagement. Based on previous research, these current data are not a valid indicator of how grades interact with these three factors.

Regarding question 3 (What strategies do students identify as motivating their participation in the virtual instruction?), the qualitative information reveals some important information and guidance for future research. These students remembered roughly between seven to 10 strategies of the 19 strategies their teachers listed (See Figure 8, Appendix G). Also, most students (20 of the 39) said the strategies were motivating (See Table 6, Appendix F). Five students mentioned specific strategies that were helpful. When asked about additional strategies that could have helped, students typically said "no" while 13 students gave specific strategies. Those who thought the strategies were motivating remembered more strategies overall (M=11.27, SD=2.28) than did those who said they were not motivating (M=7.57, SD=4.58) (See Table 7, Appendix F).

Benefits

These data reveal more about the perceived motivation in comparison with the three factors of SDT. First, it provides information about what students recall from their learning experiences during the pandemic. During a challenging year with constant changes, students could recall almost half of the strategies listed – especially students who believed they were motivating. Other strategies barely remembered might indicate the need to remove or reevaluate the strategy. This difference in memory could also represent student engagement levels. When students feel motivated, they are more engaged (Yeager & Walton, 2011). If they are not engaged, then students might not remember these strategies. This information is important for practical purposes. Teachers can receive insight about what works for their students and what things may be counterproductive.

Second, it provides evidence of what aspects students value in their academic career. The qualitative results show the importance of relationships and in-person learning. Students mentioned how having in-person activities with groups or games would have motivated them more. One student commented, “I can’t do virtual. I hate it. So in-person work and questions would’ve [been] best for me.” Students knew what they needed to be more engaged which is important to note. These results connect back to the data on the three factors. Most agreed that those three needs were met in their learning environment, and they identified what tools and strategies worked. While previous studies measured motivation and used interventions targeted at increasing motivation, this information incorporates students’ insight on motivational strategies and needs (Chiu et al., 2022; Lazowski & Hulleman, 2015).

Limitations

For this study, there are important limitations that should be considered. First, having only 39 participants did not give enough statistical power to find an effect if there was one. This is partly responsible for these statistical results. Previous researchers found that autonomy, competence, and relatedness correlate with and predict motivation (Deci & Ryan 2008, Li et al., 2020). However, this study found no relationship between any of the three variables with grades. This does not mean that the variables are not important to student success but rather these data are not valid.

Second, the sample was not representative of the population. Most of the students in this sample achieved mainly A's and B's which is not typical for most schools including this school. Six of the 39 students attended an advanced math class last year and achieved high grades. There could be two reasons for these grades. First, they may be high-achieving students and be more motivated in general than most students as seen in Higashi et al.'s 2017 study. Alternatively, research has indicated there was grade inflation during this time as teachers were more lenient due to the unique circumstances (Hamilton et al., 2020). Expectations were lower and grades could be a false representation of what these students achieved during the fall 2020 semester. Whether it was one or both factors, these variables were not examined in this current study. Future research should examine high-achieving students' motivation versus the motivation of the average or lower-achieving students. It also should survey teachers on grading practices during and after the pandemic to determine how impactful grade inflation was.

Third, there is a question about effort. From returning consent forms to completing the survey, effort appeared weak although it was not directly measured. Some

of the qualitative answers were vague or unrelated to the question. For example, one student typed “cool” for both questions. Obviously, that response does not make sense responding to open-ended questions. This may signify a motivation problem within the motivation study. Researchers have found that students sometimes give invalid responses - intentionally or unintentionally (Cornell et al., 2013). While they found students may exaggerate their responses, this current study may reveal lack of effort. Some students did not give detailed responses and took little time on a survey consisting of 30 questions. Students tend to be more engaged in class when they perceive teacher support and autonomy (Jang et al., 2016). However, that engagement level seemed to be limited in this study. While they may have had a connection with their teacher, most students did not know the researcher. Having a random person ask students to take a survey may have left them feeling disconnected and unmotivated. This difference may have impacted their effort in participation.

Fourth, there is the limitation of memory. These students had to recall their perception on these three variables of motivation and strategies used that occurred over a year ago. That can be difficult under normal circumstances, but these students also had the challenging circumstances of the pandemic. The stress of virtual learning, events occurring in the world, and personal circumstances could impact memory for students. Thus, this study may not have yielded the most accurate results due to memory difficulties. However, using the recall method for strategies rather than listing strategies may have helped alleviate some of that difficulty. Future studies should attempt to collect this information earlier rather than later to gather accurate information.

Implications for School Psychology Practice

Despite the limitations of the current study, important implications for school psychology practice can be gleaned from these results. While much of the literature focuses on the role of the administration or teachers in virtual learning during the pandemic, school psychologists play an important role in the learning environment as well. They are trained to support students, families, school systems, and communities that include motivation strategies. According to the National Association of School Psychologists (NASP; 2021), school psychology has 10 practice model domains which all could assist the needs in student motivation. These domains include making research and evidence-based decisions that promote learning. They require consultation and collaboration with others inside and outside of the school. The domains focus on the academic, behavioral, and emotional needs of the students.

One way to do that is having school psychologists lead more intervention work around relational and emotional needs. That could include assessing the needs of a school, working with key stakeholders to find interventions that are evidence-based, implementing them, and then evaluating their impact. Currently, school psychologists and other school personnel are focusing on social-emotional learning and the need to address increased anxiety among students (Frye et al., 2022; MacMillan, 2020). Part of this need may be connected to motivation through this relatedness variable. This is where a school psychologist can use their skills to research and evaluate interventions to help students succeed. Specifically, they can use this study's information to understand the impact of social isolation on student motivation from the student's perspective.

Conclusions

Motivation will remain a heavily researched topic especially after the Covid-19 pandemic because of its role in academic success (Edwards, 2009; Kim & Frick, 2011; Li et al., 2020; Wijsman et al., 2018). Prior to COVID-19, it was struggling in schools (Lazowski & Hulleman, 2015). Now, it is exacerbated by the impact of the pandemic. Some students with protective factors like parental involvement and financial support came out more resilient (Branje & Morris, 2021). However, many students without these protective factors and with more risk factors struggled through virtual learning (Branje & Morris, 2021). As previous research and this study support, students need certain things to feel motivated and engaged in academics (Doubet & Hockett, 2015; Jensen, 2005). When those needs—autonomy, competence, and relatedness—are met, students do well academically (Chiu et al., 2022; Deci & Ryan, 2008).

From this current study, the qualitative data gave evidence for student recall of strategies and what they said worked for them. When students gave feedback on what worked and what they needed to be engaged, most of their answers were about interacting with others (e.g., groups, games, and in-person activities). Statistically, there were no significant findings due to impactful limitations. Although there are limitations, this study adds to the literature about the importance of relationships in student engagement. It should prompt conversations and studies on how students view their motivational needs under unique circumstances. Also, it should be used to support student motivation and learning. While the future is unknown, school staff, like school psychologists, should prepare plans for supporting their students during challenging times.

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Appendix A

Parent/Guardian Informed Consent Form

Identification of Investigators & Purpose of Study
Your child is being asked to participate in a research study conducted by Katie Brittain, the school psychology intern in Greene County Schools, from James Madison University. The purpose of this study is to understand students' perspectives on motivation in virtual learning during the pandemic. Specifically, the study will gather information about motivation in math classes during the Fall semester of 2020. This study will contribute to the researcher's completion of her thesis for her educational specialist (Ed.S.) degree.

Research Procedures
Should you decide to allow your child to participate in this research study, you will be asked to sign this consent form once all your questions have been answered to your satisfaction. This study consists of four short surveys that will be administered to individual participants at William Monroe Middle School. Your child will be asked to provide answers to a series of questions related to motivation in virtual learning. Additionally, your child will be asked to list strategies teachers used in their class. For understanding the relationship between motivation and achievement, your child's grades will be used in a confidential way. This information will not include your student's name and will be presented with the whole grade level data – it will not single out your child's information to prevent identification of your child.

Time Required
Participation in this study will require 30 minutes of your child's time.

Risks
The investigator perceives the following are possible risks arising from your child's involvement with this study: there is a risk that your child might find these questions bringing up difficult memories and emotions as they are asked to recall school in the fall of 2020 during the COVID-19 pandemic.

Benefits
Potential benefits from participation in this study include giving insight to teachers and parents about how they can better motivate providing a space for students to discuss their experiences with online learning during a pandemic.

Incentives
You will not receive any compensation for participation in this study. Your child will receive some candy for returning their consent forms (whether signed to participate or signed not to participate).

Confidentiality
The results of this research will be presented at the investigator's thesis defense meeting and with your child's school teachers and/or administrators. Your child will be identified

in the research records by a code name or number. The researcher retains the right to use and publish non-identifiable data. When the results of this research are published or discussed in conferences, no information will be included that would reveal your child's identity. All data will be stored in a secure location accessible only to the researcher. Upon completion of the study, all information that matches up individual respondents with their answers will be destroyed.

There is one exception to confidentiality we need to make you aware of. In certain research studies, it is our ethical responsibility to report situations of child abuse, child neglect, or any life-threatening situation to appropriate authorities. However, we are not seeking this type of information in our study nor will your child be asked questions about these issues.

Participation & Withdrawal
Your child's participation is entirely voluntary. They are free to choose not to participate. Should you and your child choose to participate, they can withdraw at any time without consequences of any kind. If you and your child choose not to participate, this will not impact the services they receive at school.

Questions about the Study
If you have questions or concerns during the time of your child's participation in this study, or after its completion or you would like to receive a copy of the final aggregate results of this study, please contact:

Katie Brittain
School Psychology – Department of Graduate Psychology
James Madison University
brittakb@dukes.jmu.edu

Dr. Tiffany Hornsby, NCSP
School Psychology – Department of Graduate Psychology
James Madison University
(540) 568-3358
hornsbtc@jmu.edu

Questions about Your Rights as a Research Subject
Dr. Lindsey Harvell-Bowman
Chair, Institutional Review Board
James Madison University
(540) 568-2611
harve2la@jmu.edu

Giving Consent

I have read this consent form and I understand what is being requested of my child as a participant in this study. I freely consent for my child to participate. I have been given satisfactory answers to my questions. The investigator provided me with a copy of this form. I certify that I am at least 18 years of age.

_____

Name of Child Participant (Printed)

_____ _____

Name of Guardian (Signed) Date

_____ _____

Katie Brittain, M.A. (Signed) Date

Consent Not Given

I do not give consent for my child to participate in this study. The investigator provided me with a copy of this form. I certify that I am at least 18 years of age.

_____

Name of Child Participant (Printed)

_____ _____

Name of Guardian (Signed) Date

This study has been approved by the IRB, protocol # 22-2719.

Appendix B

Student Assent Form

IRB # 22-2719

I am inviting you to participate in this study because you are a middle school student, and we are interested in how motivated you felt to participate in virtual learning during the COVID-19 pandemic. Specifically, I want to know about your motivation in math classes during the fall semester of 2020.

This research will take you about 30 minutes to do.

Please answer to the best of your ability these survey questions on the computer. There are no right or wrong answers. We want to know what your experience and true opinions were during virtual instruction at your school. All of these questions pertain to Fall 2020. Also, you may be randomly chosen to tell me about some of the strategies your teacher used in your class during Fall 2020.

Because 2020 brought a lot of difficult experiences, you may remember some painful moments during your Fall Semester of school that year.

Your responses will be completely confidential. The survey responses will only be seen by the researchers and no individual responses will be identified in the final presentation.

We have asked your parents for their permission for you to do this study. Please talk this over with them before you decide whether or not to participate. Whether you sign to participate or sign not to participate, you can bring that form back to receive a "thank you" for considering the study - candy. The activities you have with any staff at this school, including Ms. Brittain, will not be impacted by your decision to participate or not.

If you have any questions at any time, please ask the researcher.

If you check "yes," it means that you have decided to participate and have read everything that is on this form. If you check "no," it means that you have decided not to participate. You and your parents will be given a copy of this form to keep.

_____ Yes, I would like to participate in the study.

_____	_____
Signature of Subject	Date

_____	_____
Signature of Investigator	Date

Researcher's Information:
Katie Brittain
School Psychology – Department of Graduate Psychology
brittakb@dukes.jmu.edu

_____ No, I would not like to participate in the study.

_____	_____
Signature of Subject	Date

Appendix C

Survey Items

This survey covers questions about your learning experience in mathematics during the fall semester of 2020. The answers in these surveys will remain confidential. The results will help teachers know how to make learning better based on your feedback. The survey should take between 20-30 minutes to complete. You are free to quit at any time if you would not like to continue.

ALL QUESTIONS ON THIS SURVEY ARE IN REFERENCE TO YOUR MATH CLASS IN FALL 2020.

In Fall 2020, did you attend a mathematics class virtually at XX school?
Yes No

[LCQ]

This questionnaire contains items that are related to your experience with your teacher in math class last year. Teachers have different ways of working with students, and I would like to know more about how you felt about your time with your teacher. Your specific response are not shown to your teacher. Please be truthful.

1	2	3	4	5
Strongly disagree		Neutral		Strongly agree

1. I felt that my teacher provided me choices and options.
2. I felt understood by my teacher.
3. I was able to be open with my teacher during class.
4. My teacher showed confidence in my ability to do well in math.
5. I felt that my teacher accepted me.
6. My teacher made sure I really understood the goals of the course and what I needed to do.
7. My teacher encouraged me to ask questions.
8. I felt a lot of trust in my teacher.
9. My teacher answered my questions fully and carefully.
10. My teacher listened to how I would like to do things.
11. My teacher handled people's emotions very well.
12. I felt that my teacher cared about me as a person.
13. I didn't feel very good about the way my teacher talked to me.
14. My teacher tried to understand how I see things before suggesting a new way to do things.
15. I felt able to share my feelings with my teacher.

[PCS]

Please respond to each of the following items in terms of how true it is for you with respect to your learning in virtual math classes during the fall semester of 2020.
Use the scale:

1	2	3	4	5
Not at all true		Somewhat true		Very true

1. I feel confident in my ability to learn this material.
2. I am capable of learning the material in this course.
3. I am able to achieve my goals in this course.
4. I feel able to meet the challenge of performing well in this course.

[BPNS]

The following questions deal with how you felt in general during the fall semester of 2020 in your math class. Please circle one number that fits best with what you think or feel in general. For each question there are five possible answers.

1	2	3	4	5
Completely not true				Completely true

1. The people that I like, also like me.
2. I feel excluded from the group I want to be a part of.
3. I feel close to the people I care about.
4. I feel that the people who are important to me are unkind to me.
5. I feel close to and connected with the people who are important to me.
6. The people I spend time with don't like me.
7. I have warm feelings towards the people I spend time with.
8. I feel that the relationships I have with other people are easily broken.

Follow-Up Questions: What strategies or apps did your teacher use in your Fall 2020 math class that helped you participate in virtual learning? Check each box next to the strategy that you remember:

- Quizlet
- Kahoot
- Bingo
- Desmos Activities
- Pixel Art Activities
- Guided Notes
- Video Notes
- Discussion Posts

- Google Forms
- Google Slides
- Quizizz
- Edpuzzle videos
- Wordwall Games
- Quiz Retakes
- Gimkit
- Flipgrid
- Click & Drag Notes
- Question and Response in Zoom Chat
- Zoom Breakout Rooms

How motivating were these strategies for you?

Are there other strategies not listed that would have been motivating for you?

Appendix D

Email Draft

Dear Parent/Guardian,

This email is to let you know about the possibility for your student to join a learning experience. Your student will receive a form with information about the study and a place for you to sign for whether you want your child to participate or not participate. If they return the form with a signature either approving or not approving participation, your child will receive some candy as a "thank you" for considering participation. Your decision or theirs will not impact the services they receive now or in the future at this school.

I am gathering information about how motivated students at [school's name] were in Fall 2020 and what strategies they thought were useful. This information will help guide their teachers in approaches as well as help the next generation of students. It will be gathered through a short survey that keeps your student's name private and the data will be shown as the overall ratings of students, not specific to your student's responses.

It will take place during one of their non-Core periods so they do not miss out on their core material.

Thank you for thinking about and/or letting your student help out this study!

Sincerely,

Appendix E

Presentation of the Study and Forms

Hi, everyone!

Some of you know her, but for those who don't, Ms. Brittain is the school psych intern at the middle school. I'm Ms. Deese, the school psych intern at the high school. I'm here to tell you about part of our jobs as school psychologists. It is research. Research helps us figure out how to improve school and help students do well both in school and emotionally. Ms. Brittain will be doing some research on motivation. Motivation is the driving force in someone to finish a task. How you finish homework, how you get out of bed, how you did blended or virtual school last year. Ms. Brittain wants to know what kept you driving through all that last year. Most information is from teachers' perspective about students. She wants to hear directly from you. How she would do that is by giving a survey of multiple-choice questions (no grades for this!). The last question asks what you specifically thought helpful from your teacher last year. Your perspective will be grouped together with all of 7th and 8th grade to show to your teachers (and, no, they won't know your individual responses).

This information will help them know what worked for you as students. This is literally your chance to tell your teachers what you think. Before we can do anything though, I need your parent's or guardian's permission via these forms and your desire to do this. If you can get these signed and returned to me (you can drop them off in guidance), you can earn a small prize for it. Even if your parents or guardians say "no" on the form, you can

still get that something when you return it to me. If you have any questions, ask Ms. Brittain.

Appendix F

Tables

Table 1

Research Questions in Connection with Survey Items

Research Question	Component of SDT	Survey Items
Research Question 1: To what degree did students identify autonomy, competence, and relatedness being used in in virtual instruction during the 2020-21 academic year? Research Question 2: Did students achieve higher grades when they identified higher degrees of autonomy, competence, and relatedness in their virtual instruction?	Autonomy	Learning Climate Questionnaire: 1. I felt that my teacher provided me with choices and options. 2. I felt understood by my teacher. 3. I was able to be open with my teacher during class. 4. My teacher showed confidence in my ability to do well in math. 5. I felt that my teacher accepted me. 6. My teacher made sure I really understood the goals of the course and what I needed to do. 7. My teacher encouraged me to ask questions. 8. I felt a lot of trust in my teacher. 9. My teacher answered my questions fully and carefully. 10. My teacher listened to how I would like to do things. 11. My teacher handled people's emotions very well. 12. I felt that my teacher cared about me as a person. 13. I didn't feel very good about the way my teacher talked to me. (reverse scored)

		14. My teacher tried to understand how I see things before suggesting a new way to do things. 15. I felt able to share my feelings with my teacher.
	Competence	Perceived Competence Scale: 1. I feel confident in my ability to learn this material. 2. I am capable of learning the material in this course. 3. I am able to achieve my goals in this course. 4. I feel able to meet the challenge of performing well in this course.
	Relatedness	Basic Psychological Needs Scale: 1. The people that I like, also like me. 2. I feel excluded from the group I want to be a part of. (reverse scored) 3. I feel close to the people I care about. 4. I feel that the people who are important to me are unkind to me. (reverse scored) 5. I feel close to and connected with the people who are important to me. 6. The people I spend time with don't like me. (reverse scored) 7. I have warm feelings towards the people I spend time with. 8. I feel that the relationships I have with other people are easily broken. (reverse scored)

Research Question 3: What strategies do students identify as motivating their participation in the virtual instruction?	---	Open-Ended Questions: 1. What strategies or apps did your teacher use in your Fall 2020 math class that helped you participate in virtual learning? Check each box next to the strategy that you remember: 2. How motivating were these strategies for you? 3. Are there other strategies not listed that would have been motivating for you?

Table 2

Statistical Analysis of LCQ, PCS, BPNS, and Grades

Variable	Mean	Median	Mode	Standard Deviation
Grades	9.44	10.00	11	2.28
LCQ	3.74	3.76	3.71[a]	0.69
PCS	4.03	4.25	5.00	0.93
BPNS	4.13	4.13	4.38	0.59

[a]Multiple modes exist. The smallest value is shown.

Table 3

Codes for the Grades Represented by Numbers in SPSS

SPSS Grade Key												
Letter Grade	A+	A	A-	B+	B	B-	C+	C	C-	D+	D	F
Assigned number	12	11	10	9	8	7	6	5	4	3	2	1

Table 4

Internal Consistencies of Surveys

Survey	Cronbach's alpha
LCQ	.94
PCS	.89
BPNS	.78

Table 5

Correlation Output of Grades, LCQ, PCS, BPNS (N=39)

Variable	M	SD	1	2	3	4
1. Grades	9.44	2.28	-			
2. LCQ	3.74	.69	-.016	-		
3. PCS	4.03	.93	.201	.001	-	
4. BPNS	4.13	.59	.116	.193	.061	-

Table 6

Categories of Response Types for Each Question

Question	Responses	Frequency
How motivating were these strategies for you?	They were motivating	20
	Not very motivating	9
	Specific tool mentioned (e.g. Kahoot)	5
	Vague (e.g., “cool,” “I have never been that motivated”)	5
Are there other strategies not listed that would have been motivating for you?	No not really.	23
	Specific strategy mentioned (ex: groups, in-person learning, hands-on activities)	13
	Vague (e.g., “Im not sure what thay are” [sic])	2
	Critique (e.g., “I didn’t like the discussion posts.”)	1

Table 7

Descriptive Statistics of Response Type and Number of Recognized Strategies

	Mean	Median	Mode	SD	N
Motivating	11.27	12	12	2.28	15
Somewhat Motivating	9.33	9	8	2.50	9
Not Motivating	7.57	7	2	4.58	7
Vague	10.20	10	10	2.86	5
Specified a Strategy	10.75	10.5	8	2.50	4

Table 8

Number and Mean of Grade Letter Earned in Each Class

		N	Mean Grade
	Teacher 1	7	A-
6th Grade	Teacher 2[a]	6	A-
	Teacher 3	8	B+
	Teacher 4	5	B+
7th Grade	Teacher 5	7	B-
	Teacher 6	6	A

[a]This teacher taught the advanced math class for 6th grade.

Appendix G

Figures

Figure 1

Duration of Time Spent on Survey

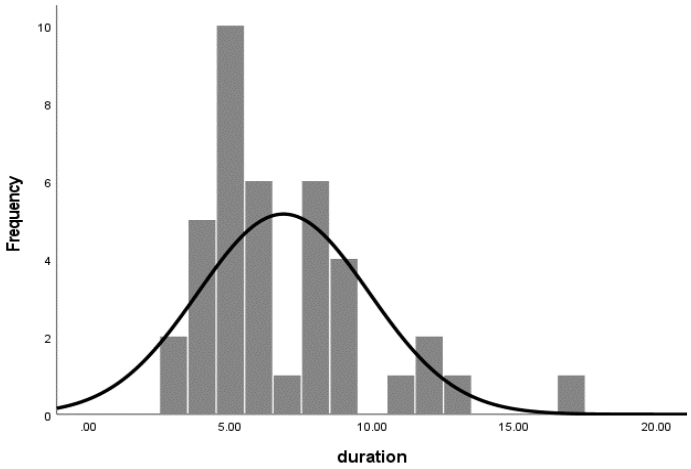

Figure 2

Frequency Distribution of LCQ Responses

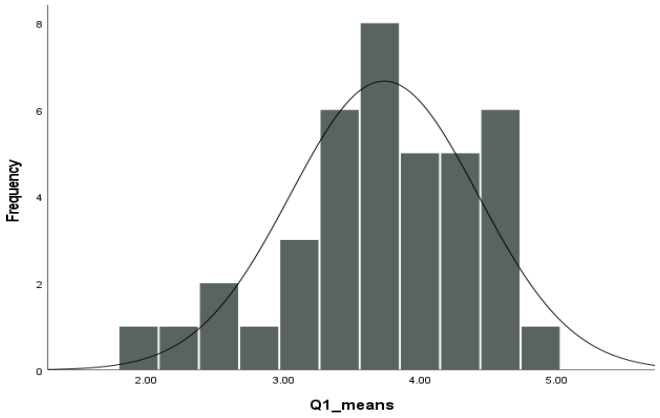

Figure 3

Frequency Distribution of PCS Responses

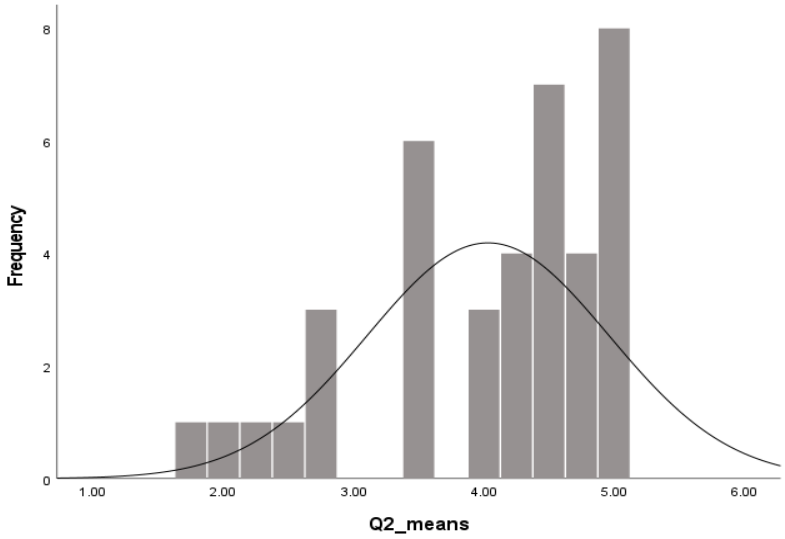

Figure 4

Frequency Distribution of BPNS Responses

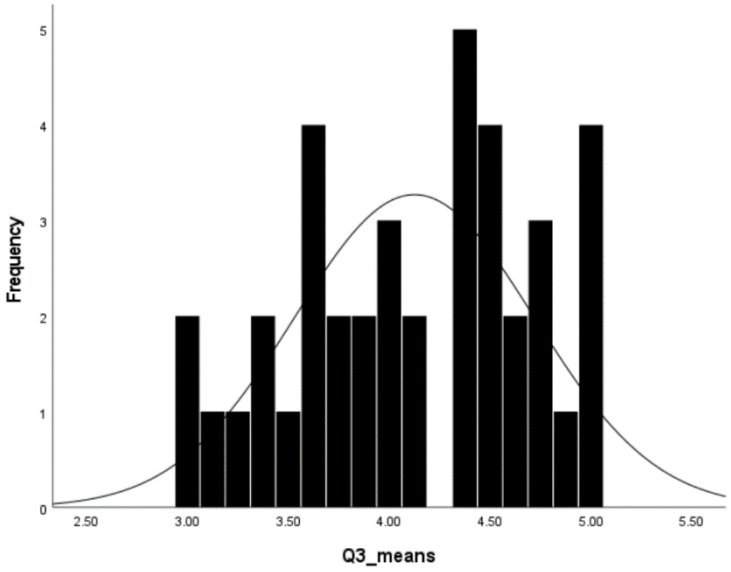

Figure 5

Regression of Grades and LCQ Responses

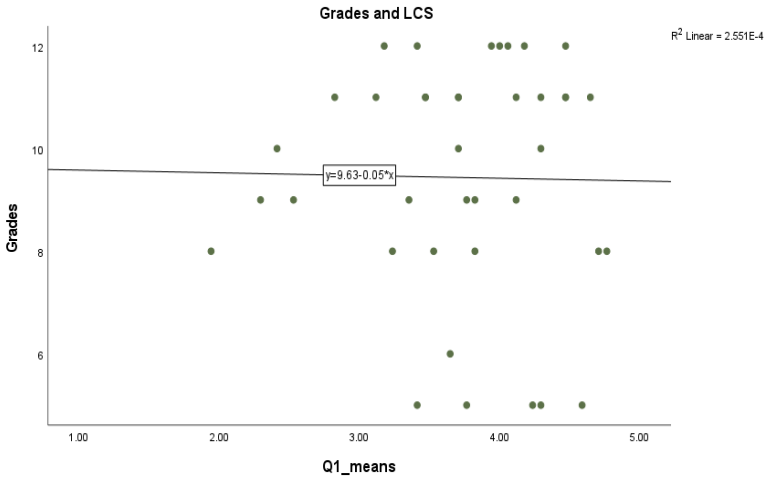

Figure 6

Regression of Grades and PCS Responses

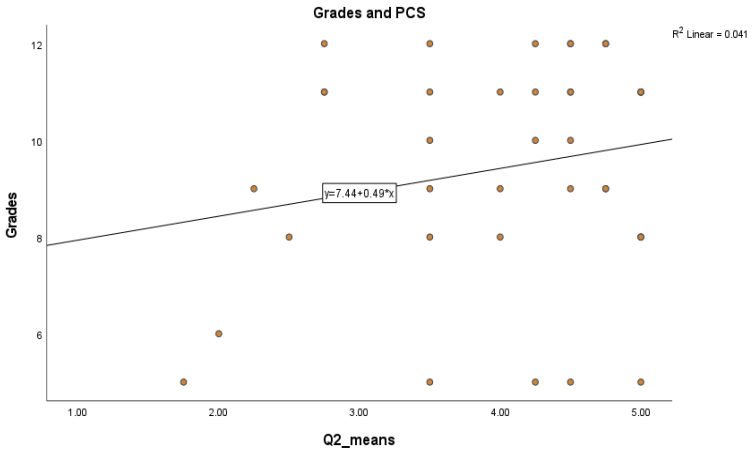

Figure 7

Regression of Grades and BPNS Responses

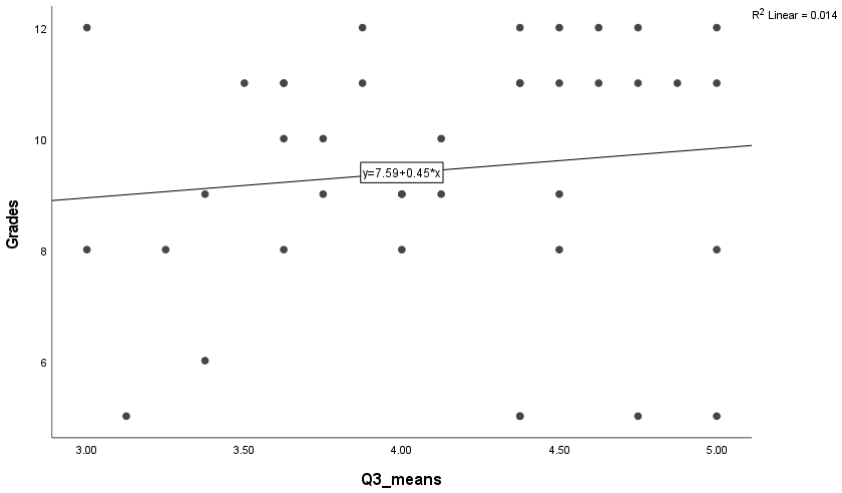

Figure 8

Frequency of Strategies Recalled